NBER WORKING PAPER SERIES

FORMAL EMPLOYEE TRAINING PROGRAMS AND THEIR IMPACT ON LABOR PRODUCTIVITY: EVIDENCE FROM A HUMAN RESOURCES SURVEY

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Working Paper No. 3026

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1989

NBER Working Paper #3026
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ABSTRACT

Although economic models of training decisions are framed in terms of a company's calculation of the costs and benefits of such training, empirical work has never been able to test this model directly on company behavior. This paper utilizes a unique database to analyze the determinants of the variation in formal training across businesses and the impact of such training on labor productivity. Major findings are that large businesses, those introducing new technology and those who rely on internal promotions to fill vacancies are more likely to have formal training programs. Formal training is found to have a positive effect on labor productivity.

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I. Introduction

According to a recent issue of Training Magazine, U.S. organizations with fifty or more employees spent $32 billion on formal programs for employee training and development. Although human resource managers argue that training is critical for developing a productive workforce, very little is known about how companies make decisions about budgets for formal training and whether such training increases measured labor productivity. Previous research by labor economists on employee training has focused on the impact of training on the individual's success in the labor market, i.e. how training raises the individual's wage and reduces the probability of a layoff. Economists have also studied why employers are more likely to train certain individuals than others, and, in particular, have shown that individuals who are expected to stay with the firm are more likely to be the recipients of training. Hence, economic research on training has been concerned with the impact of investments in training on the distribution of earnings. Likewise, research on training by industrial and organizational psychologists has been conducted at the individual level, focusing on the impact of training on the employee's cognitive skills, work effort, and morale.

This paper is unique in that it focuses on the organization as the unit of observation. Although economic models of training decisions are framed in terms of a company's calculation of the costs and benefits of such training, empirical work has never been able to test this model directly on company behavior. Researchers have been forced to make inferences about company behavior based on data on the careers of individuals. By utilizing a unique data base on human resource practices in U.S. businesses, I am able to study the variation in the training effort

across companies. A simple economic model is used to derive several testable hypotheses about the variables that can explain why some businesses invest more in employee training than others. The role of firm characteristics, such as technological change and firm size, as well as characteristics of the company's industry, such as the extent of competition in the product market, are studied. The impact of formal training programs on labor productivity is also analyzed.

In the next section of the paper, the literature on employee training is summarized in order to show the types of data that have been available to researchers who have previously studied the topic of employee training. In Part III, I describe the survey I am using and discuss its strengths and weaknesses relative to other databases that have been used for the study of employee training. Part IV specifies a simple model that is tested with the survey data. In Part V, the impact of training of labor productivity is measured. Conclusions are provided in Part VI.

II. Literature Review

In this section of the paper, I summarize the literature that exists on the subject of employee training and development. In preparing this summary, I have reviewed work by economists and industrial psychologists as well as the results of previous surveys of corporate training programs.

A. Economists

Economists who study on-the-job training have primarily been interested in modelling who receives training and how it affects the individual's growth in earnings over his working life. Examples of this literature are the studies by Mincer (1983, 1987), Brown (1983), Lillard and

Tan (1986), Pergamit and Shack-Marquez (1986), Barron et al. (1987, 1988) and Lynch (1988). These studies use data from national surveys such as the Panel Study of Income Dynamics, the National Longitudinal Surveys, the Current Population Survey and the Employment Opportunities Pilot Project. Information on training from the first three data sets is obtained directly from the individuals who are surveyed. For example, in the Panel Study of Income Dynamics, which was used by Mincer and Brown, individuals are asked "On a job like yours, how long would it take the average person to become fully qualified?" and "Are you learning skills on the current job which could lead to a better job or promotion?" The National Longitudinal Surveys, which were used by Mincer, Lillard and Tan, and Lynch, contain a variety of training questions depending on the particular cohort that was surveyed. For example, in the older NLS cohorts, the training questions are "Do you receive or use additional training (other than schooling training) on your job?" and "What was the longest type of training you have had since the last interview?" The NLS youth cohort, however, contains information on all training spells in the respondents' working life and it is possible to separate company training from apprenticeship training. The individuals in this survey were first interviewed in 1978 when they were between the ages of 14 and 21 and have been re-surveyed every year or two since that time. The January 1983 Current Population Survey, used by Lillard and Tan and Pergamit and Shack-Marquez, contains the following question on training: "What training was needed to get the current or last job and what training is needed to improve skills on the current job?" Finally, the 1980 Employment Opportunities Pilot Project Dataset, used by Barron et al., is unique in

that it surveys employers. The employers were asked to provide information on the amount of on-the-job training provided their most recently hired worker, as measured by the number of hours typically spent by various personnel in training such an individual.

The main findings of this research can be summarized briefly. Individuals who receive training are likely to be young, white males. Most studies also find that the more educated individuals receive more training than the less educated. Private sector training is found to play a significant role in the wage determination and career patterns of young workers; individuals with more training have significantly larger wage growth and longer job tenure. The data from the EOPP Survey also show that individuals who received more training in their first three months of employment have significantly faster productivity growth during their first two years with the employer.

B. Industrial Psychologists

Industrial psychologists have studied the effects of employee training utilizing experimental methods and case studies. They have measured the effectiveness of training in one of four ways: (1) subjective learning (judgments of course participants or trainers); (2) objective learning (results on standardized tests); (3) subjective behavior (changes in on-the-job behavior, as perceived by course participants, peers or supervisors); and, least commonly of all, (4) objective results (tangible indicators such as reduced costs, improved quality or quantity of output). An excellent survey of studies conducted by industrial psychologists on the subject of managerial training is provided in Burke and Day (1986). They review seventy articles that evaluated the effectiveness of training programs for managerial or supervisory personnel in

various companies. In all of these studies, the individual is the unit of observation and individuals who received training are compared to those who were not in the training program. The comparisons are made on the basis of scores on skill or knowledge tests, performance rankings, ratings during role play, and survey ratings by subordinates. Only a handful of these studies evaluated training programs in terms of objective results. The best example of the latter type of study is the one conducted by James S. Russell et al (1985) in which 62 retail stores belonging to the same international merchandising organization were the units of observation. Russell et al found that sales volume per employee was positively and significantly correlated with the percentage of sales personnel who received training in basic sales procedures and with the sales personnel's perceptions of the emphasis given training in the store.

The main problem with these studies is that each one is limited to a relatively small group of individuals (normally between 50 and 100) in one company so that it is difficult to generalize the findings beyond the company under study. Although the Russell article examines 62 companies, they are in the same industry and belong to the same organization. In her critique of the psychological research, Ingols (1987) accuses the researchers of minimal cross-referencing; "they do not look for common themes across companies, but focus on the specific case at hand." She concludes that this line of research has left us with a limited and fragmented knowledge about the role of training in corporations.

C. Surveys of Corporate Training Programs

Information on investments in employee training can also be obtained from surveys that are conducted by various organizations. For example,

each year, Lakewood Research, a division of Lakewood Publications, the publisher of Training Magazine, conducts a survey of U.S. organizations with 50 or more employees. Respondents are asked for information on the amount their organization budgets for formal training, the number of individuals who receive training during the year, and the number of hours of training they receive. The information from approximately 2400 respondents is extrapolated by Lakewood Research to a universe of 230,000 organizations and reported in aggregate figures only. For example, the results of the 1987 survey, published in May 1988, indicate that $32 billion was budgeted for formal training that year with 38.8 million workers scheduled to receive 1.2 billion hours of training. The survey also described the types of training (e.g. management skills, technical skills, clerical skills, sales skills, etc.) provided by the respondent companies and showed how these differ across industries and size of firm.

A second example of a corporate survey is the study prepared by The Conference Board in 1975 (Lusterman, 1977). They surveyed 2800 companies that had at least 500 employees and received usable responses form 610 firms. These data were then extrapolated to the universe of 7600 firms. Information on per employee expenditures for formal in-house training, tuition aid and other outside training was obtained. The main findings of this study were that the companies spent an average of $60 per employee on the three types of training, $48 of which was spent on formal in-house training; large companies spent more per employee than small companies; and the share of the training budget attributed to formal in-house training rose from 47% for the firms in the smallest size category to 87% for the firms in the largest size category. Converting

the 1975 expenditures to 1987 dollars would produce an expenditure of $93 per employee on formal in-house training.

In 1985, The Conference Board surveyed 218 companies to obtain information on changes in corporate education and training that had occurred in the previous five years (Lusterman, 1985). While this new report did not contain any cost information, it discussed how the training function had increased in importance at the surveyed companies. A larger proportion of employees in all major job categories were involved each year in formal training as compared to five years earlier. The companies reported that they were strengthening and widening the role of corporate training departments and were using more sophisticated methods to evaluate the need for and to assess the impact of employee training.

A third example of a corporate survey is the one conducted by the Battelle Human Affairs Research Center in 1987 (see Saari et al., 1988). This group sent a mailed questionnaire to 100 U.S. companies randomly selected from all private-for-profit companies having at least 1000 employees. While the response rate was excellent (61%), the survey only collected data on management training. The information is in the form of categorical variables such as the company's use of formal on-the-job training, mentoring, job-rotation, training needs assessment and training evaluation systems. The survey also collected information on the reasons companies give for selecting various training program approaches (e.g. external vs. internal), and the process used to select participants for these programs. The major finding from this survey is that 89% of the companies reported using formal training/education programs with usage of this training being positively correlated with company size. In spite of

the prevalence of formal training, there was limited evidence of systematic evaluations of management training by the companies in this sample.

D. Summary

As this literature review has revealed, what we know about employee training is that it has positive career impacts on the individuals who receive it, that U.S. companies spend a fair amount on formal training, and that many case studies conclude that employee training is effective in improving job performance. What is lacking, however, is a clear understanding of why some companies invest heavily in employee training and others do not. To date, no one has been able to study the variation in formal training across businesses, to describe the factors that determine that variation, and to analyze the impact of formal training on the organization's labor productivity; with the exception of the EOPP survey, the focus has always been on variation in training across individuals. It is the purpose of the current research to shift the focus of analysis to the company that is making the training decision.

III. The Columbia Business School Human Resources Survey

In 1987, the Industrial Relations Research Center of the Columbia Business School conducted a survey of human resources policies and practices in American businesses. A questionnaire was sent to the executives responsible for 7,765 business units during the time period covering the fall of 1986 though the spring of 1987. The name and address of the executive in charge of each unit was obtained from the Compustat data files. Responses were received from 854 business units (11 percent response rate), though useable data were received from only 493 business units (6.4 percent overall response rate). Although this

response rate is low, it is not substantially different from the response rates obtained by analysts who conducted much less comprehensive surveys of organizations' HRM policies (for example, see Hitt and Ireland, 1986). The businesses in the Columbia survey are smaller than those used in the Battelle survey. Fifty-percent of our businesses have fewer than 900 employees; twenty-five percent have fewer than 240 employees. Recall that the Battelle survey only included businesses with at least 1000 employees and this may, in part, explain why their response rate was so high. We did indeed have a better response rate from larger business units. Responding business units tended to be larger than nonrespondents and reported significantly higher sales, operating income, capital expenditures, assets, and equity than nonrespondents. The industrial distributions of the two groups were very similar.

The survey instrument sent to COMPUSTAT business units elicited detailed data pertaining to 1986 on organizations' HRM policies and practices covering various occupational groups: (1) managers; (2) unionized and (3) nonunion professional and technical workers; (4) unionized and (5) nonunion clerical workers; and (6) unionized and (7) nonunion manufacturing and production workers. Information on training and development, selection, evaluation and compensation policies, and communication and employee involvement policies was obtained for each of these groups. In addition, the business units provided information about their overall human resource planning.

The data from the human resources survey have been merged with the data on the COMPUSTAT files. Hence, for each of the business units in the survey, we have information on capital expenditures, value of assets, operating income, research and development expenditures, and net sales.

Demographic characteristics of the business's employees are proxied by the characteristics of the employees in the organization's industry and geographic labor market, as reported in the Current Population Survey data. In addition, for the business units in the manufacturing sector, we have information on the following attributes of the business unit's four-digit SIC category: concentration ratio, value of exports, value of imports, value of the capital stock, value of inventories, value of shipments, total factor productivity, energy expenditures, and number of employees. Data on these variables are available for the time period 1958-1984 inclusive.

On the subject of employee training and development, the survey asks several questions as they pertain to <u>each</u> of the seven occupational groups. The questions for each of these groups are:

(1) Does your business have a formal employee training and development program?

(2) If yes, when was the program instituted?

(3) If yes, who participates in decisions about the types of training and development program undertaken by your business?

(4) What was the approximate cost of formal training and development programs per employee in your business last year?

(5) What indicators are used to assess employee training and development (e.g. employee opinions, productivity on the job, cost-benefit analysis)?

As this list indicates, the only measure of <u>amount</u> of training is the cost figure. Unlike the EOPP Survey, information on time spent by supervisors or others in training individuals or the amount of time it

takes for a newly hired individual to become "trained", was not solicited. A follow-up questionnaire is being prepared to obtain these data.

Although the response rate in the Columbia survey is low relative to those of the surveys of corporate training programs discussed in the previous section, the Columbia survey clearly surpasses the others in terms of the wealth of detail that is available on the company's human resource policies and its economic characteristics. As I show in the next section of the paper, these data are critical elements of a model of corporate investments in employee training. The earlier studies that utilized corporate surveys were not concerned with hypothesis testing regarding variation in the training effort across businesses and, hence, could conduct a less intensive data collection effort while concentrating on maximizing sample size. The Columbia Business School Survey took an alternative approach, namely, the need to collect a large amount of information from each respondent in order to be able to systematically study how and why human resource policies and practices differ across American businesses.

Table 1 reports mean values for training questions (1), (3), and (4) above for each of the seven occupational groups. Formal training programs are used in one-third to one-half of the businesses in our sample, depending on the occupational group under study. These training programs have been in existence longer for unionized employees than nonunionized workers. Unfortunately, data on the cost of formal training per employee were reported by a small percentage of the businesses in the sample. However, these data can be utilized to make a rough estimate of the total amount that the average business spent on training. Assuming that it had the average number of employees in each employee category, the average

business would have spent about $5.5 million on training in 1986. Multiplying this figure by the number of businesses in the COMPUSTAT files (including those without useable names and addresses for executives) would result in a total expenditure of $55 billion for 1986.[1]

Table 2 provides information on the prevalence of formal training programs across industry categories. The variable PCTTRAIN, defined as the percentage of occupations in each business for which a formal training program existed, is calculated, and mean values by industry are reported. As Table 2 shows, the mean value of PCTTRAIN is .412, with a low of .083 in the entertainment services industry and a high of .635 in the transportation industry. We also see that retail trade and the finance and insurance industry have above average values for the training index.

As the data in Table 1 indicated, many companies with formal training programs did not respond to the question regarding the cost of formal training per employee. Since this variable is particularly important for measuring variation in training intensity across business, we need to explore why some businesses answered this question and others did not. In particular, the existence of selectivity bias must be considered. Table 3 provides more detail on this issue by showing how the response rate varied across occupation groups and across size categories where the businesses are divided into four quartiles based on number of employees. Each entry in Table 3 shows, for each occupation, the percentage of

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[1]Unlike the COMPUSTAT "company" dataset, the COMPUSTAT "business-line" data set does not include a weighting factor that would have enabled me to calculate an estimate of the amount spent on training by the population of U.S. businesses.

businesses with a formal training program that reported cost of training for that program. The entries in parentheses show the percentage of businesses with formal training programs for that occupation. The data show no clear pattern. While the response rate initially rises with size, it falls off for the very large businesses. Although these large organizations are most likely to have formal training programs, they either do not have or choose not to report information on cost of training. The entries in Table 3 are highly correlated across occupations. In other words, if a company reports training costs for one occupation, it reports it for the others as well. Indeed, the correlations across occupations are all above .75, and, in many cases, exceed .9. This suggests that firm characteristics aside from size may be important in explaining the response rate.

To test this hypothesis, I estimated a binary logit model on the subset of firms that reported having a formal training program for the particular occupation under study; the dependent variable equals one of the businesses reported cost of training information, and equals zero if it did not. Three categories of variables are used. The first describes the economic characteristics of the business unit and includes SIZE - the number of employees, ROA - return on assets, calculated as the ratio of net income to identifiable assets and CAPLAB - the capital-labor ratio, calculated as the ratio of capital expenditures to the number of employees. The second category describes the business's human resource policies and includes YRPGM - the year in which the training program was instituted, and POLICY - an index measuring the degree of sophistication

of the business unit's human resource policies.[2] The third category is a set of industry dummies where the excluded category is finance, insurance and real estate.[3] The binary logit results are shown in Table 4 for managers and the three nonunion occupations; sample sizes were to small for the unionized occupational categories. There is no evidence in Table 4 of any systematic relationship between the business's economic characteristics and the probability of reporting training cost information; neither SIZE nor ROA have significant effects and CAPLAB is significant in only one equation. Businesses with more sophisticated human resource policies are not more likely to report cost information, and in one case, are even less likely to report it. The year the training program was instituted is significant in only one case. In sum, there is no obvious explanation as to why some companies reported training costs and others did not. My guess is that many respondents were not sure what costs should be included in our definition and/or they were unable to readily locate a cost measure for their organization.

IV. Determinants of Company Training Programs

In this section of the paper, I show how a simple model can be specified and estimated to explain the observed variation in the presence

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[2]The index is defined as follows. The organization receives one point for each yes answer to the following questions: (1) Does the organization have a formal written HRM plan? Does the organization formally evaluate policies developed in the following HRM areas: (2) Work organization and job design? (3) Employee selection and staffing? (4) Employee training and development? (5) Communication and participation programs? (6) Performance appraisal? (7) Compensation? (8) Union-management relations? (9) Employee relations?

[3]The industry variables are NONDUR - nondurable manufacturing, DUR - durable manufacturing, TRANSP - transportation, WHTRADE - wholesale

of formal employee training programs across the businesses in our sample.

A. A Basic Framework

Using the assumption that the businesses in our sample are profit-maximizers, we can derive several testable hypotheses about the determinants of company training expenditures. The company's profits are defined as gross sales minus the wage bill, training expenditures, and all other expenditures on inputs:

$$(1) \qquad \Pi = P_x X - wL - tL - rK$$

where P = the price of the the product X, X = the quantity of output produced, w = the wage rate, L = the quantity of labor utilized, t = training expenditures per unit of labor, K = a composite index of all other factors of production, and r = the per unit cost of this composite index.

Maximizing Π with respect to t, training expenditures per unit of labor, results in the following condition:

$$(2) \qquad \frac{\partial}{\partial t}\left(\frac{X}{L}\right)P_x = 1$$

which simply states that the business will choose that level of t where the marginal return from an additional dollar spent per worker on training just equals its marginal cost. According to the left-hand side of equation (2), the marginal return from an additional dollar spent per worker will be higher in those businesses where the average product of

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trade, RETAIL - retail trade, BUSSERV - business and repair services and PERSERV - personal services.

labor is more sensitive to investments in training. Equation (1) can be modified to describe the company's maximization problem as one of maximizing the discounted flow of future profits. In this case, the marginal return on a current expenditure on training will equal the discounted sum of increases in the average product of labor over the expected working life (T) of the company's employees:

$$(3) \qquad \sum_{i=1}^{T} \frac{\partial}{\partial t}\left(\frac{X}{L}\right)_i \cdot P_{X_i} = 1$$

We can derive several hypotheses about the variation in per worker training expenditures across businesses by considering what factors are likely to lead to a greater sensitivity of the average product of labor to training expenditures. First is the degree of technological change in the firm. Companies that are introducing new technology have a greater need to train their employees in order to implement the technology and reap its benefits. The productivity of labor in this type of company will be more sensitive to training because the potential for learning is greater. A second variable to study is the average tenure of the workers in the company. As equation (3) indicates, the payoff from training is higher in those companies where employees are likely to stay longer. Third, the role of company size needs to be considered. As the literature review indicated, previous surveys have shown that large companies spend more per employee on formal training than small companies. If tenure is longer, on average, in large companies than small ones, this could explain the role of size. If this is not the case, then, according to equation (2), the only way to explain the role of size is to argue that labor productivity is more sensitive to training in large firms than

in small ones. There are two possible explanations. The first is based on the argument that it is more difficult to monitor worker productivity in large firms. According to this view, training is more critical in large firms, than small firms, ceteris paribus, because workers are more likely to shirk there. A second explanation relies on the notion of public goods. Instead of expressing training expenditures as the product of per worker expenditures and the number of workers, we could simply write total training expenditures, T. Then the marginal return from an additional dollar spent on T will be greater in large firms because a one dollar increase in T will increase the productivity of all workers. While this is a somewhat extreme case, it is consistent with a perhaps more realistic notion that there are "economies of scale" in the provision of training; one supervisor can teach a class of trainees and each trainee could learn as much as he would have in a private training session. Finally, product competition should play a role in the firm's calculation of the returns to training. For example, a company that is facing tough competition from domestic competitors or from foreign companies may increase its investments in employee training as a way of improving product quality and lowering production cost.

B. Empirical Specification

The hypotheses discussed above are tested on the survey data using the binary variable on the presence of a formal training program.[4] The data are stacked so that the number of observations equals the number of

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[4]The training cost variable was also used and produced very poor results. In light of the low response rate on this question and the difficulty that companies may have had in interpreting it, the poor results are not surprising.

companies multiplied by the number of occupation groups in the company. The equation that is estimated is:

$$(4) \qquad TR_{ij} = \alpha_0 + \alpha_1 FIRM_j + \alpha_2 OCCV_{ij} + \alpha_3 OCCDUM_i$$

where TR_{ij} equals one if business j has a formal training program for occupation i, and zero otherwise; $FIRM_j$ is a vector of characteristics describing the firm such as size, technological change, industry dummies, industry characteristics, and the extent of human resource planning in the company; $OCCV_{ij}$ is a vector of variables describing the business's human resource practices that are specific to the occupation; and $OCCDUM_i$ is a vector of occupation dummies. As equation (4) is specified, the coefficients on the variables in $OCCV_i$ are constrained to be the same across all occupations but the equation will also be estimated without this restriction.

The variables in the vector $FIRM_j$ are measured as follows. First, the degree of technological change in the business is measured in several ways. I use the ratio of R&D expenditures to sales (RDRATIO) and the ratio of capital expenditures to the number of employees in the business (CAPLAB). These two variables are calculated from the COMPUSTAT files. The extent of technological change in the business's industry is also proxied by the average education level of workers in that industry. As Bartel and Lichtenberg (1987) have shown, industries undergoing technological change increase their demand for educated workers because education increases an individual's ability to learn new things and to adapt to environmental changes. Hence, we would expect that businesses in industries with highly educated workers are more likely to be introducing new technology, and, as the model showed, will therefore be more likely

to invest in employee training and development.[5] The average education of workers in the company's three-digit SIC industry (EDUC) is calculated from the 1983 Current Population Survey. The size of the business is obtained directly from the survey responses to the questions regarding number of workers in each occupational category (SIZE). When this was unavailable, information on the number of employees was obtained from the COMPUSTAT files. In order to control for variation in the importance of human resource policies to business strategy, a variable measuring the extent of human resource planning in areas other than employee training in the organization was calculated from the survey. This variable, called HRPOLICY, is similar to POLICY defined in footnote 1; the only exception is the deletion of the response to the question on training. Information on product competition in the business's industry is only available for the businesses in the manufacturing sector and refers to the four-digit SIC category of which the business is a member. Two variables are used to measure product competition. The first, the concentration ratio in the industry (CRATIO), is a measure of the extent of domestic competition. There are two problems with this variable. First, the latest date for which it is available is 1982, and, second, it can be argued that even in industries with high concentration ratios, the degree of competition among the leaders in the industry can be very intense. In the absence of these problems, CRATIO should have a negative coefficient. The second variable, the ratio of net imports (imports

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[5]Education can also have a direct effect on formal training, rather than simply working indirectly through technological change. Since more educated individuals are better learners, the marginal return on a dollar spent on training will be higher for these people.

minus exports) to the industry's total value of shipments (IMPSHARE), is used to measure the degree of foreign competition that the domestic firms face. The coefficient on IMPSHARE should be positive if employee training is used as a device to improve productivity and competitiveness relative to foreign producers.

Two variables are included in $OCCV_{ij}$. The average tenure of employees in each occupation was not available on the survey, but was proxied by the response to the following question: "To the best of your knowledge, about what percentage of your nonentry level jobs have been filled from internal sources in recent years?" This variable (INTPROM) should be highly correlated with average tenure, since businesses that rely on internal promotions will have long tenure employees compared to businesses that hire from the outside. The variation in the extent to which the businesses screen job candidates for different occupations may also play a role in the decision to train. Presumably, organizations that benefit from trained workers will screen applicants more carefully in order to reduce training costs. A variable measuring whether or not job candidates are required to take a written or other formal test of skill (SCREEN) is used and is expected to be positively correlated with training.[6]

The occupation dummies are defined as UPROF -- unionized professional and technical, NUPROF -- nonunion professional and technical, UCLER -- unionized clerical, NUCLER -- nonunion clerical, UMFG -- unionized

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[6]In their analysis of the EOPP data, Barron et al (1987) found a significant positive correlation between screening of applicants and intensity of training.

manufacturing and production workers, and NUMFG -- nonunion manufacturing and production. The excluded category is managers.

C. Results

Table 5 contains the results of estimating a binary logit model where the dependent variable equals one if the business reported that it had a formal training and development program for the particular occupational group, and zero otherwise. In Column (1), businesses in all industries are included, while Columns (2) and (3) include only those in manufacturing. The predictions of the model are generally confirmed. Two of the three indicators of technological change, LCAPLAB and RDRATIO, are positive and significant in all three columns. EDUC is positive but insignificant possibly because it refers to the industry group to which the business belongs and is therefore not specific to the business itself. The size of the business, LSIZE, is always positive and significant. Whether this is due to the "shirking" problem or to economies of scale in the provision of training unfortunately cannot be determined.[7] The other firm characteristics, CRATIO and IMPSHARE, also have the expected signs in the manufacturing sector; formal training programs are more likely to be used as product market competition increases, as measured by either a decrease in CRATIO or an increase in IMPSHARE.

The occupation related variables, INTPROM and SCREEN, also have the predicted signs. Training programs are more likely to be used as average

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[7]Since the dependent variable refers to formal training only, the impact of firm size on informal training can not be ascertained. Haber (1989) provides evidence based on wage growth patterns in the Survey of Income and Program Participation that individuals who work in small firms are more likely to receive informal training than individuals

tenure, as proxied by INTPROM, increases, and as screening intensity increases. The occupation dummy variables themselves are also significant, indicating greater reliance on formal training for managers as compared to the other groups. Table 6 shows the interactions of INTPROM and SCREEN with the occupation dummies. The effect of tenure on the probability of a formal training program is strongest for managers. According to the model, this implies that a business's calculation of the returns on formal training is more closely related to tenure when training managers as compared to the other occupation groups. Screening and training are also more highly correlated for managers as compared to all other groups except unionized professionals.[8]

V. The Effect of Training on Labor Productivity

A. Empirical Specification

In order to measure the impact of formal employee training on labor productivity, I assume that the production functions for the businesses in the survey can be represented by a Cobb-Douglas function and that there are two inputs in the production process, capital, K, and "effective labor", EL. Effective labor is the amount of labor services that

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in large firms. Whether this finding would be supported by data collected from businesses in my sample is the subject of future research.

[8] It is possible to estimate a fixed effects model by including a set of business dummy variables in equation (4). The fixed effects model only includes the variables in $OCCV_{ij}$, and the occupation dummies since the variables in $FIRM_j$ are perfectly correlated with the business dummies. When this model was estimated, the coefficients on INTPROM and SCREEN decreased in magnitude but remained significant, and the pattern of the coefficients on the occupation dummies followed the one shown in Table 5.

are actually supplied by the workers that the company employs. Let the number of workers employed be represented by the variable, R, or reported labor. Then the effective labor input is given by:

$$EL = R(1+t) \tag{5}$$

where t is an index of the amount of training that each worker receives. According to equation (5), workers that receive more training provide more "effective labor" input to the firm. The production function can be written as:

$$Q = AK^{\beta}EL^{\gamma} \tag{6}$$

or substituting equation (5) into (6), results in:

$$Q = AK^{\beta}(R(1+t))^{\gamma} \tag{6a}$$

In the data I observe output per worker, or Q/R, which is written in equation (7) as:

$$Q/R = AK^{\beta}R^{\gamma-1}(1+t)^{\gamma} \tag{7}$$

Taking logarithms of both sides of equation (7) gives the equation that will be estimated:

$$\ln (Q/R) = \ln A + \beta \ln K + (\gamma-1)\ln R + \gamma t \tag{8}$$

assuming that t is a small number.

Equation (8) is estimated across all of the businesses in the survey and each business is treated as an observation. The dependent variable is calculated as sales per worker, K is capital expenditures and R is the number of employees. In order to measure the extent of training in the

organization, two variables were calculated from the survey. The first, PCTTRAIN, is the percentage of occupations in the business for which formal training is conducted. If training programs exist for all of the occupations in the business, this variable equals one; if there are no formal training programs, the variable equals zero; if there are training programs for some occupations and not others, the variable takes on a value between zero and one.[9] The second variable that is used is based on questions posed to those companies that had training programs regarding how they evaluate the success of their programs. The companies were asked to indicate what indicators are used to assess employee training; one of the indicators was productivity on the job. For each company, I calculated the percentage of occupations for which a formal training program existed and the company assessed that program based on an indicator of productivity on the job. This variable is called ASSESSPRD. It seems likely that ASSESSPRD should have a stronger effect on labor productivity than PCTTRAIN since companies that are assessing productivity effects will likely be designing their training programs with productivity impacts in mind.

The other variables that are included in the labor productivity equation are the percentage of employees in the business that are unionized, (PCUNION), the average job tenure of all employees, calculated as an average of the proxy for tenure used in the previous analysis, (INTPROM),

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[9]An alternative variable is the percentage of employees for whom the business provides a formal training program. Unfortunately, about one-quarter of the businesses did not provide complete data on the number of employees in each occupation category (even when they provided data on the human resource policies applicable to each occupation) so utilizing this variable would have substantially reduced the sample size.

the percentage of occupations for which job candidates are required to take a formal test based on the occupation responses to the variable SCREEN, the extent of human resource planning in the organization (HRPLCY), and a vector of industry dummy variables.

B. Results

The results of estimating equation (8) are shown in Table 7. In columns (1) through (3), training is measured by PCTTRAIN, and in columns (2) through (4), training is measured by ASSESSPRD. According to equation (8), the coefficient on LGKEXP is the elasticity of output with respect to capital while the elasticity of output with respect to labor is obtained by adding one to the coefficient on LSIZE. In addition, the specification in equation (8) indicates that the coefficient on the training variable should not be significantly different from the labor elasticity.

In equations (1) and (3), the effect of training on labor productivity is estimated without controlling for any of the other human resource policy variables such as INTPROM, SCREEN and HRPLCY. Both training variables have positive and significant effects using a one-tailed test. In columns (2) and (4), INTPROM, SCREEN and HRPLCY are included in the equation and neither of the training variables remains significant. Tenure (as measured by INTPROM) and skill testing of applicants (SCREEN) have positive and significant effects on labor productivity. In columns (3) and (6), SCREEN is deleted but INTPROM and HRPLCY are kept in the equation. The training measure ASSESSPRD becomes significant again, and the coefficient on PCTTRAIN recovers almost to its original magnitude and significance level. Since businesses that train

also rely more heavily on skill testing of job applicants and the screening of applicants contributes significantly to raising labor productivity, the results in columns (2) and (5) show that this relationship swamps the independent effect of training on productivity. Although companies that train also have lower turnover which enhances labor productivity, unlike the effect of screening, this does not eliminate the effect of training on productivity as shown in columns (2) and (5).

In terms of the other variables in equation (8), the elasticity of output with respect to capital is estimated to be .50 and the elasticity of output with respect to labor is .38.[10] Unionization has a positive effect in all equations and the effect is significant when tenure is deleted. Finally, when the equations were estimated restricting the coefficient on the training variable to equal one plus the coefficient on LSIZE, the hypothesis regarding the restriction could not be rejected at the 5 percent level of significance.

VI. Conclusions

This paper has utilized corporate survey data to study employee training and development. The review of previous research showed that most studies of training rely on data provided by individuals and therefore focus on the variation in training across individuals and its impacts on their career advancement. Although economic models of training decisions are framed in terms of a company's calculation of the costs

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[10] In a stepwise regression analysis, LSIZE and LKEXP were the first variables to enter the equation, with coefficients of -.526 and .446, respectively, implying a scale factor of .92.

and benefits of such training, empirical work has never been able to test this model directly on company behavior.

The econometric analysis of the determinants of the variation in training across the businesses in the sample showed that the predictions of the profit-maximization model were borne out. For example, large businesses, those introducing new technology, and those with a high proportion of internal promotions were more likely to have formal training programs. In addition, the extent of product competition in the business's industry had the expected sign. Formal training was found to have a positive effect on labor productivity, especially in those businesses that evaluated their training programs based on productivity indicators. An important finding is that the increase in productivity attributable to training is largely due to the fact that businesses that train rely heavily on screening of job applicants which significantly enhances labor productivity.

How does this analysis contribute to the debate on the market's ability to provide "enough" formal training for employed adults? On the one hand, we can argue that the companies in this sample are providing the right amount of formal training because we observe their behavior to be consistent with the predictions of the profit-maximization model. These companies provide formal training when it is in their best interests to do so, and we find that this training raises labor productivity. Alternatively, we saw that only one-third to one-half of the businesses have formal training programs for various occupation groups. If the goal is to insure that virtually all American workers have the opportunity to participate in formal training programs at the work site, this statistic suggests that there is not enough training. In order to induce American

businesses to provide more formal training, public policymakers would need to create the right incentives; policy changes that increase the perceived marginal return or reduce the marginal cost (e.g. training vouchers) of providing such training would be required. But it seems more reasonable to argue that employers themselves have better information regarding labor market conditions, the market for their goods and services, and the potential benefits of new technology, all of which are used to judge the potential benefits from additional investments in training. Employers who consistently underinvest in training should eventually succumb to the superior productivity of competitors who invest more.

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Table 1

Training Programs and Training Expenditures[a]

Variable	Managers	Professional/ Technical Employees		Clerical Employees		Manufacturing/ Production Employees	
		Union	Nonunion	Union	Nonunion	Union	Nonunion
Percent With a Formal Training Program	49.2% (488)	47.3% (55)	45.1% (468)	37.7% (85)	32.9% (474)	47.5% (162)	40.6% (323)
Mean Age of Program in Years	12 (222)	22 (21)	13 (188)	20 (26)	14 (143)	20 (62)	12 (115)
Mean Cost of Training Per Employee	$1,343 (101)	$1,037 (3)	$1,408 (84)	$873 (6)	$368 (70)	$470 (26)	$359 (49)
Total Cost of Training Per Business	$1,164,821 (89)	N.A.	$2,108,745 (74)	N.A.	$229,513 (62)	$706,526 (23)	$1,299,167 (42)

[a]The sample size is in parentheses.

[b]Calculated by multiplying the training cost per employee by the number of employees in the occupational category.

Table 2

Mean Value of PCTTRAIN, By Industry*

Industry	PCCTRAIN
1. All (N = 491)	.412
2. Mining (N = 28)	.200
3. Construction (N = 3)	.167
4. Nondurable Manuf. (N = 70)	.463
5. Durable Manuf. (N = 154)	.254
6. Transportation (N = 83)	.635
7. Wholesale Trade (N = 10)	.242
8. Retail Trade (N = 27)	.536
9. Finance, Ins., Real Estate (N = 59)	.531
10. Business & Repair Services (N = 34)	.480
11. Personal Services (N = 8)	.217
12. Entertainment Services (N = 5)	.083
13. Professional Services (N = 10)	.467

*PCTTRAIN = proportion of occupations for which the business had a formal training program.

Table 3

Percentage of Businesses With Formal Training Programs That Reported Cost of Training, By Size Quartile*

	SIZE 1 (2-241)	SIZE 2 (242-898)	SIZE 3 (899-3900)	SIZE 4 (3901-316900)
1. Managers	.386 (.358)	.386 (.396)	.413 (.563)	.337 (.769)
2. Unionized Professional/ Technical	0.0 (.286)	0.0 (.273)	.333 (.500)	.063 (.666)
3. Nonunionized Professional/ Technical	.328 (.382)	.368 (.355)	.400 (.519)	.343 (.638)
4. Unionized Clerical	0.0 (.167)	0.0 (0.0)	.375 (.381)	.091 (.611)
5. Nonunionized Clerical	.395 (.247)	.371 (.321)	.413 (.422)	.291 (.519)
6. Unionized Manufacturing/ Production	.111 (.581)	.333 (.462)	.400 (.392)	.270 (.627)
7. Nonuionized Manufacturing/ Production	.378 (.336)	.357 (.373)	.313 (.421)	.244 (.594)

*Numbers in parentheses show the percentage of businesses with formal training programs.

Table 4

Probability of Reporting Cost of Training Given that Formal Training Program Exists

	Managers	Nonunion Prof/Tech	Nonunion Clerical	Nonunion Mfg/Prod
SIZE	-.128 (-1.45)	-.038 (-.41)	-.025 (-.26)	-.298 (-1.27)
ROA	.604 (1.24)	1.07 (1.41)	.55 (.75)	1.95 (1.02)
CAPLAB	-4.82 (-.98)	-5.52 (-.83)	-3.56 (-.72)	40.48 (1.86)
YRPGM	-.01 (-.32)	.002 (.13)	-.01 (-.68)	-.05 (-2.05)
POLICY	-.014 (-.32)	-.03 (-.64)	-.01 (-.15)	-.15 (-2.19)
NONDUR	.198 (.34)	-.40 (-.65)	-.80 (-.96)	1.58 (.82)
DUR	.785 (1.49)	-.01 (-.11)	--- ---	2.19 (1.18)
TRANSP	1.30 (2.49)	.53 (.94)	.73 (1.41)	.89 (.47)
WHTRADE	.93 (.63)	--- ---	--- ---	--- ---
RETAIL	1.54 (2.38)	1.15 (1.32)	1.36 (1.78)	3.73 (1.87)
BUSSERV	1.05 (1.67)	1.11 (1.63)	1.99 (2.57)	.45 (.21)
PERSERV	2.19 (1.57)	--- ---	--- ---	--- ---
Constant	-.55 (-.44)	-.70 (-.55)	-.136 (-.09)	1.08 (.57)
N	186	155	121	102

Table 5

Binary Logit Models of Presence of Formal Training Program
(Stacked Data)

Independent Variable	(1) All Industries* (N = 1694)	(2) Manufacturing Only (N = 853)	(3) Manufacturing Only (N = 849)
LSIZE	.26	.19	.21
	(7.46)	(3.61)	(3.75)
LCAPLAB	.12	.18	.20
	(2.92)	(2.58)	(2.68)
RDRATIO	3.27	4.83	5.52
	(2.69)	(2.38)	(2.67)
HRPLCY	.13	.16	.17
	(7.17)	(5.91)	(5.99)
SCREEN	1.04	1.29	1.23
	(7.26)	(6.11)	(5.79)
INTPROM	.01	.02	.02
	(4.78)	(5.30)	(5.29)
EDUC	.12	.05	.15
	(1.45)	(.40)	(1.18)
UPROF	-1.10	-1.42	-1.47
	(-2.94)	(-1.70)	(-1.73)
NUPROF	-.28	-.08	-.08
	(-1.62)	(-.32)	(-.34)
UCLER	-2.28	-2.38	-2.39
	(-6.77)	(-3.97)	(-3.93)
NUCLER	-1.49	-1.69	-1.67
	(-7.63)	(-5.75)	(-5.66)
UMFG	-.61	-.88	-.89
	(-2.58)	(-2.55)	(-2.56)
NUMFG	-.44	-.61	-.66
	(-2.34)	(-2.56)	(-2.52)
IMPSHARE			.99
			(2.74)
CRATIO			-.01
			(-1.30)

*The excluded industry category is finance, insurance, and real estate. The coefficients and t-values on the industry dummies are MIN, -2.80 (-6. CONS, -1.89 (-1.94), NONDUR, -1.34 (-4.48), DUR, -1.90 (-6,80), TRANSP, -.74 (-2.49), WHTRADE, -2.05 (-4.52), RETAIL, -.75 (-2.05), BUSREP, -.34 (-1.82), PERSS, -2.12 (-2.42), ENTERT, -2.87 (-3.52), and PROFSER, -1.62 (-2.45).

Table 6

Interactions of SCREEN and INTPROM with Occupation Dummies*

Independent Variable	(1) SCREEN	(2) INTPROM
No Interaction	1.01 (2.94)	.01 (4.00)
UPROF Interaction	1.33 (1.59)	-.003 (-.27)
NUPROF Interaction	.05 (.45)	-.005 (-1.04)
UCLER Interaction	-.17 (-.23)	-.03 (-2.50)
NUCLER Interaction	-.41 (-.95)	-.02 (-3.02)
UMFG Interaction	.46 (.80)	-.003 (-.40)
NUMFG Interaction	.26 (.57)	-.01 (-1.23)

*All other variables shown in Table 5 were included in these regressions.

Table 7

Dependent Variable: Log (Output per Worker)*

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
LSIZE	-.62	-.64	-.63	-.62	-.64	-.63
	(-18.89)	(-18.69)	(-18.37)	(-19.08)	(-18.68)	(-18.44)
LKEXP	.50	.50	.50	.50	.50	.50
	(19.20)	(18.74)	(18.47)	(19.27)	(18.78)	(18.55)
PCTTRAIN	.18	.11	.17	--	--	--
	(1.64)	(.88)	(1.45)	--	--	--
ASSESSPRD	--	--	--	.20	.13	.21
	--	--	--	(2.10)	(1.30)	(2.11)
PCUNION	.35	.29	.30	.33	.28	.29
	(1.79)	(1.45)	(1.50)	(1.71)	(1.43)	(1.46)
INTPROM		.49	.48	--	.48	.47
		(2.76)	(2.72)	--	(2.77)	(2.70)
SCREEN		.39	--	--	.37	--
		(2.45)	--	--	(2.29)	--
HRPLCY		-.02	-.01	--	-.02	-.02
		(-1.17)	(-1.03)	--	(-1.23)	(-1.15)
CONSTANT	1.30	1.05	1.14	1.30	1.05	1.13
	(5.71)	(4.39)	(4.78)	(5.68)	(4.39)	(4.74)
R^2	.59	.61	.60	.59	.61	.60
N	409	387	390	409	387	390

*All equations include a vector of industry dummies.